

**What Is Claimed Is:**

1           1. A method of measuring a constraint parameter of a component for a combination  
2 of circuit parameters according to which an integrated circuit is implemented, said component  
3 being designed for use in said integrated circuit, said method comprising:

4           estimating said constraint parameter for said combination of circuit parameters based  
5 on correct constraint parameter values of one or more of other combinations of said circuit  
6 parameters to generate an estimated value; and

7           searching around said estimated value to determine a correct value for said constraint  
8 parameter for said combination of circuit parameters.

1           2. The method of claim 1, wherein said circuit parameters comprise slew rates of a  
2 data signal and a clock signal.

1           3. The method of claim 1, wherein said searching comprises:  
2 performing a first simulation of said component using said estimated value for said  
3 constraint parameter;

4           determining whether said first simulation returns a pass result;  
5 if said first simulation returns said pass result, setting a first search range with a higher  
6 end equaling said estimated value and a lower end equaling (said estimated value less a first  
7 value); and

8           if said first simulation does not return said pass result, setting said first search range  
9 with said lower end equaling said estimated value and said higher end equaling (said  
10 estimated value plus a second value).

1           4. The method of claim 3, wherein said searching further comprises:  
2           performing a second simulation of said component using a second search value for  
3           said constraint parameter, wherein said second search value is contained in said first search  
4           range;  
5           determining whether said second simulation returns said pass result;  
6           if said second simulation returns said pass result, setting a second search range with  
7           a higher end equaling said second search value;  
8           if said second simulation returns said pass result and if said first simulation also  
9           returned said pass result, setting a lower end of said second search range to equal (said lower  
10          end of said first search range less a third value), wherein said third value is more than said  
11          first value;  
12          if said second simulation does not return said pass result, setting said lower end of  
13          second search range to equal said second search value; and  
14          if said second simulation does not return said pass result and if said first simulation did  
15          not return said pass result, setting said higher end of said second search range to equal (said  
16          higher end of said first search range plus a fourth value), wherein said fourth value is more  
17          than said second value.

1           5. The method of claim 4, further comprising determining a third search range with  
2           said higher end of said third search range returning said pass result and said lower end not  
3           returning said pass result.

1           6. The method of claim 5, further comprising performing a binary search in said third  
2 search range to determine said correct value of said constraint parameter.

1           7. The method of claim 5, further comprising:  
2           generating a curve with delay as a function of constraint parameter values, wherein  
3 said curve is generated based on at least said first simulation and said second simulation;  
4           selecting a plurality of intermediate points in said third search range;  
5           determining an expected delay associated with each of said plurality of intermediate  
6 points using said curve;  
7           comparing said each expected delay with a threshold to determine whether said  
8 expected delay is acceptable or unacceptable, wherein said expected delay is deemed  
9 acceptable if said expected delay is less than said threshold and unacceptable otherwise; and  
10          determining a next point of simulation based on the results of said comparing.

1           8. The method of claim 7, wherein said plurality of intermediate points comprise a 1/3  
2 point and a 2/3 point in said third search range.

1           9. The method of claim 8, wherein said next point comprises said 2/3 point if the  
2 results of said comparing are both deemed to be unacceptable, wherein said next point  
3 comprises said 1/3 point if the results of comparing of both are deemed to be acceptable,  
4 wherein said next point comprises an intermediate point in said third search range otherwise.

1           10. The method of claim 7, further comprising:

performing a third simulation using a parameter value corresponding to said next point; and  
setting a fourth search range based on a result of said third simulation.

11. The method of claim 5, wherein said component comprises a flip-flop.

12. The method of claim 11, wherein said pass result is returned if said component is functional for the corresponding search point and if a delay from an input to an output of said flip-flop is within a threshold.

13. A method of searching for a correct value of a constraint parameter of a component based on a plurality of points, wherein said plurality of points contain a first pass point and a first fail point, wherein said correct value is contained in a first search range defined by said first pass point and said first fail point, wherein each of said plurality of points is associated with a corresponding one of a plurality of values of said constraint parameter, said method comprising:

generating a curve with delay as a function of said plurality of points;  
selecting a plurality of intermediate points in said first search range;  
determining an expected delay associated with each of said plurality of intermediate points using said curve;  
comparing said each expected delay with a threshold to determine whether said expected delay is acceptable or unacceptable, wherein said expected delay is deemed acceptable if said expected delay is less than said threshold and unacceptable otherwise; and

14 determining a next point of simulation based on the results of said comparing.

1 14. The method of claim 13, wherein said plurality of intermediate points comprise  
2 a 1/3 point and a 2/3 point in said first search range.

1 15. The method of claim 14, wherein said next point comprises said 2/3 point if the  
2 results of said comparing are both deemed to be unacceptable, wherein said next point  
3 comprises said 1/3 point if the results of comparing of both are deemed to be acceptable,  
4 wherein said next point comprises an intermediate point in said first search range otherwise.

1 16. The method of claim 13, further comprising:  
2 performing a simulation using a parameter value corresponding to said next point; and  
3 setting a fourth search range based on a result of said simulation.

1 17. The method of claim 13, wherein said curve is represented in the form of an  
2 equation.

1 18. A system for measuring a constraint parameter of a component for a combination  
2 of circuit parameters according to which an integrated circuit is implemented, said component  
3 being designed for use in said integrated circuit, said system comprising:

4 means for estimating said constraint parameter for said combination of circuit  
5 parameters based on correct constraint parameter values of one or more of other combinations  
6 of said circuit parameters to generate an estimated value; and

7 means for searching around said estimated value to determine a correct value for said  
8 constraint parameter for said combination of circuit parameters.

1 19. The system of claim 18, wherein said circuit parameters comprise slew rates of  
2 a data signal and a clock signal.

1 20. The system of claim 19, wherein said searching comprises:  
2 means for performing a first simulation of said component using said estimated value  
3 for said constraint parameter;  
4 means for determining whether said first simulation returns a pass result;  
5 means for setting a first search range with a higher end equaling said estimated value  
6 and a lower end equaling (said estimated value less a first value) if said first simulation returns  
7 said pass result; and  
8 means for setting said first search range with said lower end equaling said estimated  
9 value and said higher end equaling (said estimated value plus a second value) if said first  
10 simulation does not return said pass result.

11 21. A machine readable medium carrying one or more sequences of instructions  
12 for causing a system to measure a constraint parameter of a component for a combination  
13 of circuit parameters according to which an integrated circuit is implemented, said component  
14 being designed for use in said integrated circuit, wherein execution of said one or more  
15 sequences of instructions by one or more processors contained in said system causes said  
16 one or more processors to perform the actions of:

17           estimating said constraint parameter for said combination of circuit parameters based  
18   on correct constraint parameter values of one or more of other combinations of said circuit  
19   parameters to generate an estimated value; and  
20           searching around said estimated value to determine a correct value for said constraint  
21   parameter for said combination of circuit parameters.

1           22. The machine readable medium of claim 21, wherein said circuit parameters  
2   comprise slew rates of a data signal and a clock signal.

1           23. The machine readable medium of claim 21, wherein said searching comprises:  
2           performing a first simulation of said component using said estimated value for said  
3   constraint parameter;  
4           determining whether said first simulation returns a pass result;  
5           if said first simulation returns said pass result, setting a first search range with a higher  
6   end equaling said estimated value and a lower end equaling (said estimated value less a first  
7   value); and  
8           if said first simulation does not return said pass result, setting said first search range  
9   with said lower end equaling said estimated value and said higher end equaling (said  
10   estimated value plus a second value).

1           24. The machine readable medium of claim 23, wherein said searching further  
2   comprises:  
3           performing a second simulation of said component using a second search value for

4 said constraint parameter, wherein said second search value is contained in said first search  
5 range;

6 determining whether said second simulation returns said pass result;

7 if said second simulation returns said pass result, setting a second search range with  
8 a higher end equaling said second search value;

9 if said second simulation returns said pass result and if said first simulation also  
10 returned said pass result, setting a lower end of said second search range to equal (said lower  
11 end of said first search range less a third value), wherein said third value is more than said  
12 first value;

13 if said second simulation does not return said pass result, setting said lower end of  
14 second search range to equal said second search value; and

15 if said second simulation does not return said pass result and if said first simulation  
16 also did not return said pass result, setting said higher end of said second search range to  
17 equal (said higher end of said first search range plus a fourth value), wherein said fourth value  
18 is more than said second value.

1 25. The machine readable medium of claim 24, further comprising determining a third  
2 search range with said higher end of said third search range returning said pass result and said  
3 lower end not returning said pass result.

1 26. The machine readable medium of claim 25, further comprising performing a  
2 binary search in said third search range to determine said correct value of said constraint  
3 parameter.



1           27. The machine readable medium of claim 25, further comprising:  
2           generating a curve with delay as a function of constraint parameter values, wherein  
3           said curve is generated based on at least said first simulation and said second simulation;  
4           selecting a plurality of intermediate points in said third search range;  
5           determining an expected delay associated with each of said plurality of intermediate  
6           points using said curve;  
7           comparing said each expected delay with a threshold to determine whether said  
8           expected delay is acceptable or unacceptable, wherein said expected delay is deemed  
9           acceptable if said expected delay is less than said threshold and unacceptable otherwise; and  
10          determining a next point of simulation based on the results of said comparing.

1           28. The machine readable medium of claim 25, wherein said component comprises  
2           a flip-flop, and wherein said pass result is returned if said component is functional for the  
3           corresponding search point and if a delay from an input to an output of said flip-flop is within  
4           a threshold.

1           29. A machine readable medium carrying one or more sequences of instructions  
2           for causing a system to search for a correct value of a constraint parameter of a component  
3           based on a plurality of points, wherein said plurality of points contain a first pass point and  
4           a first fail point, wherein said correct value is contained in a first search range defined by said  
5           first pass point and said first fail point, wherein each of said plurality of points is associated  
6           with a corresponding one of a plurality of values of said constraint parameter, wherein

7 execution of said one or more sequences of instructions by one or more processors contained  
8 in said system causes said one or more processors to perform the actions of:

9 generating a curve with delay as a function of said plurality of points;

10 selecting a plurality of intermediate points in said first search range;

11 determining an expected delay associated with each of said plurality of intermediate  
12 points using said curve;

13 comparing said each expected delay with a threshold to determine whether said  
14 expected delay is acceptable or unacceptable, wherein said expected delay is deemed  
15 acceptable if said expected delay is less than said threshold and unacceptable otherwise; and

16 determining a next point of simulation based on the results of said comparing.

1 30. The computer readable medium of claim 29, further comprising:

2 performing a simulation using a parameter value corresponding to said next point; and

3 setting a fourth search range based on a result of said simulation.

1 31. A system for searching for a correct value of a constraint parameter of a  
2 component based on a plurality of points, wherein said plurality of points contain a first pass  
3 point and a first fail point, wherein said correct value is contained in a first search range  
4 defined by said first pass point and said first fail point, wherein each of said plurality of points  
5 is associated with a corresponding one of a plurality of values of said constraint parameter,  
6 said system comprising:

7 means for generating a curve with delay as a function of said plurality of values;

8 means for selecting a plurality of intermediate points in said first search range;

9 means for determining an expected delay associated with each of said plurality of  
10 intermediate points using said curve;  
11 means for comparing said each expected delay with a threshold to determine whether  
12 said expected delay is acceptable or unacceptable, wherein said expected delay is deemed  
13 acceptable if said expected delay is less than said threshold and unacceptable otherwise; and  
14 means for determining a next point of simulation based on the results of said  
15 comparing.

1 32. The system of claim 31, further comprising:

2 means for performing a simulation using a parameter value corresponding to said next  
3 point; and  
4 means for setting a fourth search range based on a result of said simulation.